Muon Accelerator Program
Design & Simulations (WBS 2)
Monthly Status Review

June 7, 2013

Outline

- Introduction
- L2 Manager Updates
- AOB

Introduction

- Highlights
  - 325 MHz Front End and Acceleration; chicane; 3 GeV, 1 MW scenario
  - Rectilinear cooling
  - HF IR fringe fields, vibrations
  - Detector/near-IP model; MARS15 algorithms; time gating
  - nuSTORM ring design; instrumentation
- Preparation of suggested topics for SBIR 2014
- Participation at Tohoku Workshop on Higgs and Beyond
- Next Monday's D&S meeting (11AM Eastern)
  - V. Kapin, "Fringe Field Effects in Higgs Factory Collider"
  - K. Abdalgaffer, "Parallel Optimization Tools for Muon Collider Design"
- Upcoming events:
  - Coordinated MICE & MAP Collaboration Meetings:
    - MICE Meeting: June 17-18 at IIT
    - Joint Day: June 19 at Fermilab
    - MAP Meeting: June 20-22 at Fermilab

L2 MANAGER STATUS REPORTS: DESIGN & SIMULATION (WBS 2)

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WBS: 02.01 – Proton Driver

Presenter: Keith Gollwitzer

Milestone Status (Progress)

- In progress: Project X – MAP Task Force Report
- To be started: IDS-NF Proton Driver costing study

Resource Conflicts, Plan Changes and Issues

- Task Force team focused on other topics

Late Items

- Task Force Report

Summary of Previous Month

- Recent MASS presentation provided staging scenarios and desired proton driver needs

Upcoming Work (Next Month)

- 2nd iteration of Task Force Report
- Look at Project X stage 2 as a proton driver (3 GeV).

Quarterly Plans

- Develop Accumulator and Compressor Rings
- Develop Compressor Ring extraction line to target for NF
- IDS-NF Proton Driver description and costing
- Investigate re-use of Project X pulsed linac for muon acceleration

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WBS: 02.02

Presenter: Diktys Stratakis

Milestone Status (Progress)

- Chicane shielding and energy deposition work
- Alternative taper schemes for the decay channel
- Global optimization of the front end
- NEW: Studies towards a 3 GeV, 1 MW Scenario

Resource Conflicts, Plan Changes and Issues

Late Items

Summary of Previous Month

- Studies on a low taper scenario for the 325 MHz FE
- Evaluate buncher/ rotator for this scheme using optimizer.
- Energy deposition and shielding studies for the chicane
- Chicane integration in ICOOL and G4BL
- Particle production studies for a 3 GeV scenario

Upcoming Work (Next Month)

- Advance chicane coil/shielding studies
- Optimize the capture section for the 3 GeV proton beam driver case.
- Study the impact of proton beam bunch length on the performance of the front end.

Quarterly Plans

- Use ROOT to evaluate coil/Shielding scenario for the chicane
- Implement optimization tools on NERSC
- Use optimization algorithms to optimize the FE cooling channel.

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WBS: 02.03 Cooling

Presenter: Tom Roberts

Milestone Status (Progress)

Resource Conflicts, Plan Changes and Issues

- **Need funding for Missing Physics Processes**
- **Need engineering study on Guggenheim final stages**

Late Items

- **Missing Physics Processes**

Summary of Previous Month

- **EPIC: Continuing…**
- **HCC: Looking at effect of charge separation and pre-cooling**
- **Half-Flip (Balbekov) channel simulations, separate absorbers (flat and wedge – trans. cooling and emit. exch.)**
- **Physics Processes: Ongoing…**

Upcoming Work (Next Month)

- Guggenheim D&S (Stratakis et al)
- HCC D&S (Yoshikawa et al)
- Half-flip channel (Balbekov), include stochastic processes
- Final Cooling D&S (Palmer)
- Physics Processes (Snopok, Roberts): plasma effects, others, …

Quarterly Plans

- 6D Baseline Selection
  - Need some preparatory work
  - (Basically on hold awaiting the other 6D D&S tasks)
- Guggenheim D&S
- HCC D&S
- FOFO Snake D&S
- Half-Flip channel
- Auxiliary components
- Final Cooling D&S
- Missing Physics Processes

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WBS: 02.04 – D&S Acceleration Presenter: J. Scott Berg

Milestone Status (Progress)

- Complete lattices for IDS-NF acceleration
- IDS-NF RDR Linac/RLA section: not begun
- Just beginning Higgs factory acceleration chain

Resource Conflicts, Plan Changes and Issues

- Some messing around with baseline frequencies and acceleration plan, related to MASS. Will know more next month.

Late Items

- Behind target on FFAG acceleration chain

Summary of Previous Month

- Some FFAG calculations
- 325 MHz acceleration for 5 GeV neutrino factory

Quarterly Plans

- Q3-4: Setting up Higgs factory FFAG calculations
- Q3-4: IDS-NF RDR Linac/RLA section

Upcoming Work (Next Month)

- Calculations to support FFAG-based acceleration chain design
- Start acceleration section for IDS-NF RDR

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WBS: 02 05 Collider Ring Design Presenter: Y. Alexahin

Milestone Status (Progress)

- Higgs Factory (HF) design with account of detector protection from backgrounds – getting ready for 2nd iteration.
- Study of effects of field imperfections in wide-aperture IR magnets on beam dynamics in Higgs Factory – almost done.
- Longitudinal dynamics studies in Higgs Factory with account of beam-beam forces and wake-fields – going on.
- Upgrade of the 3TEV collider lattice with combined-function magnets – on hold

Resource Conflicts, Plan Changes and Issues

- All of the studiers were mostly occupied with other tasks or on vacations.

Late Items

Summary of Previous Month

- Effect of realistic fringe field profile studied for the HF IR magnets using imported from COSY-Infinity maps and found to be quite pronounced but not detrimental (Kapin).
- Analysis of possible HF IR magnet vibrations was started in order to check if the beam pipe radius in IR can be reduced from 5 to 4 sigmas as requested by the MDI group.

Quarterly Plans

- Update of the Higgs Factory collider lattice design based on the detector background simulations.
- Correction of the effects of field imperfections in wide-aperture IR magnets on beam dynamics in HF.
- Self-consistent longitudinal dynamics simulations for HF

Upcoming Work (Next Month)

- Continued work on the HF collider lattice design.
- Correction with octupoles of the effects of fringe fields and body multipoles in wide-aperture IR magnets of the HF collider.
- Continued longitudinal dynamics simulations for HF

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WBS: 02.06 - Machine-Detector Interface Presenter: Nikolai Mokhov

Milestone Status (Progress)

- Developments of physics and geometry modules of MARS15 for adequate modeling of heat loads in SC magnets and backgrounds in HF and MC detectors
- Development of MARS model of HF IR with large-aperture magnets, MDI and detector.
- Development of background hit rate reduction techniques.

Resource Conflicts, Plan Changes and Issues

At the moment, still waiting for a consistent design (geometry and magnetic field maps) of the IR combined function quadrupole and dipole magnets.

Late Items

Consistent IR magnet design.

Summary of Previous Month

- Issues with overlapping of a large-angle hermetic nozzle and detector components have been resolved, a unified model of the detector and near-IP machine components built and ready for simulations.
- MARS15 algorithms for efficient tracking of low-energy electrons in complex geometry in presence of a strong magnetic field have been further improved.
- Further studies of time gate techniques.

Upcoming Work (Next Month)

- Implement new IR magnet models in the IR/MDI MARS model.
- Launch Higgs Factory MARS runs on backgrounds and heat loads to IR components.
- If successful, study the properties of backgrounds in HF detector with the new magnet, MDI and detector models.

Quarterly Plans

- Q3: Optimization of HF magnet protection system and MDI. Production MARS runs to feed the detector studies. With this source, launch full detector simulations.

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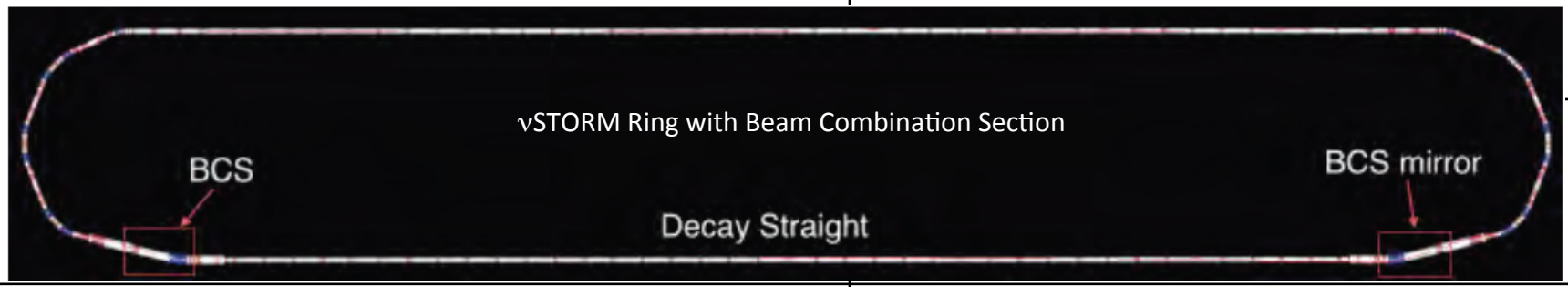
WBS: Decay Rings 02 07

Presenter: Alex Bogacz

Milestone Status (Progress)

A. Liu



Resource Conflicts, Plan Changes and Issues

Summary of Previous Month

Lars Soby - nuSTORM Instrumentation

1. Measure the circulating muon intensity (on a turn by turn basis) to 0.1% absolute.
2. Measure the mean momentum to 0.1% absolute.
3. Measure the momentum spread to 1% (FWHM).
4. Measure the tune to 0.01.

Upcoming Work (Next Month)

- A. Liu – Develop chromaticity correction scheme with sextupoles for the new ring with DBA arcs for νSTORM
- A. Liu – νSTORM Dynamic Aperture studies with G4BL for the new ring.
- D. Kelliher – Scheme for injecting both positive and negative muons into the ring, injection timing to equalize neutrino fluxes for both species.

Quarterly Plans

- Large acceptance ring design for νSTORM
  - Pursue both FODO and FFAG Racetrack designs
  - Continue lattice optimization and Dynamic Aperture study for both designs
- Ring design for NF
  - Finalize 10 GeV ring design for IDS-NF
  - Finalize injection into the ring for both charge species
  - Adapt 10 GeV ring design (IDS-NF) for 4 GeV L3NF at Fermilab

AOB

- Are there any other issues for today's discussion
- Questions?
- Comments?